

WHAT IS CLAIMED IS:

1. An assembly for determining at least one of tilt and height of a surface of a substrate in a lithographic apparatus, the assembly comprising:

a substrate table configured to move said substrate along at least one path substantially parallel to the surface of said substrate;

a sensor configured to measure said at least one of tilt and height along said at least one path; and

a memory configured to store measurement data of said sensor for use during a later exposure of said substrate by said lithographic apparatus,

wherein said at least one path of the substrate is at least partly inclined with respect to an exposure scanning direction of said lithographic apparatus.

2. An assembly according to claim 1, wherein said sensor is configured to measure said at least one of tilt and height substantially along at least part of an edge contour of the substrate.

3. An assembly according to claim 2, wherein said sensor is configured to measure said at least one of tilt and height along the edge contour of the substrate in one go.

4. An assembly according to claim 2, wherein said sensor is further configured to approximate a geometry of the edge contour during a measurement of said at least one of tilt and height.

5. An assembly according to claim 4, wherein an approximation of the geometry of the edge contour is done by measuring along at least one of a plurality of straight lines that together follow said edge contour, a step-by-step path along said edge contour, and a contour substantially equal in shape to said edge contour.

6. An assembly according to claim 1, wherein said sensor is further configured to measure said at least one of tilt and height along a plurality of subsequent paths having gaps between them in which no measurement is performed.

7. An assembly according to claim 1, wherein said sensor comprises a sensor including at least one sensing spot configured to measure height, said sensor being switchable between an on and an off state, which switching is effected as a function of a position of said sensor.

8. An assembly according to claim 1, wherein said sensor includes a plurality of sensing spots and wherein said sensor is further configured to measure said at least one of tilt and height only with a subset of the plurality of sensing spots along at least part of said at least one path.

9. An assembly according to claim 1, wherein said substrate comprises a target portion near an edge contour of said substrate and wherein during later exposure of said target portion said stored measurement data from a plurality of paths are used.

10. A lithographic projection apparatus comprising:
a radiation system configured to supply a beam of radiation;
a support structure configured to support a patterning structure, said patterning structure configured to pattern said beam of radiation according to a desired pattern;
a substrate table configured to support a substrate and to move said substrate along at least one path substantially parallel to a surface of said substrate;
a projection system constructed and arranged to project the patterned beam of radiation onto a target portion of the substrate, and
an assembly for determining at least one of tilt and height of a surface of a substrate in a lithographic projection apparatus, the assembly comprising:
a sensor configured to measure said at least one of tilt and height along said at least one path; and
a memory configured to store measurement data of said sensor for use during a later exposure of said substrate by said lithographic projection apparatus,
wherein said at least one path of the substrate is at least partly inclined with respect to an exposure scanning direction of said lithographic projection apparatus.

11. A lithographic projection apparatus according to claim 10, wherein said lithographic projection apparatus is configured to project said radiation beam on a focal plane, to read the measurement data from the memory and to use the measurement data to adjust the position of the substrate to bring a target portion located on the substrate upon irradiation by the radiation beam into the focal plane of said radiation beam.

12. A lithographic projection apparatus according to claim 10, wherein said sensor, during a measurement of said at least one tilt and height, irradiates said substrate with at least one spot, a maximum distance between the at least one spot and an edge contour being in a range of about 0.5 mm to 4 mm.

13. A lithographic projection apparatus according to claim 12, wherein the maximum distance between the at least one spot and an edge contour of said substrate is in a range of about 1.5mm to 2.5mm.

14. A method for determining at least one of tilt and height of a surface of a substrate in a lithographic projection apparatus, the method comprising:

moving the substrate along at least one path substantially parallel to the surface of said substrate;

providing measurement data about said at least one of tilt and height along said at least one path; and

storing said measurement data in a memory for use during a later exposure of said substrate by said lithographic projection apparatus,

wherein said at least one path of said substrate is at least partially inclined with respect to an exposure scanning direction of said lithographic projection apparatus.

15. A method according to claim 14, further comprising:

patterning a beam of radiation;

projecting the patterned beam of radiation onto a target portion of a layer of radiation-sensitive material provided on said substrate;

scanning said substrate in the exposure scanning direction, and

using said measurement data during exposure of said substrate.

16. A method according to claim 15, further comprising reading said at least one of tilt and height data from said memory,

wherein said projecting comprises projecting the patterned beam of radiation on a focal plane on said substrate, and

wherein using said measurement data during said exposure of said substrate comprises adjusting a position of said substrate to bring said target portion optimally in the focal plane of said radiation beam.

17. A method according to claim 14, further comprising measuring said at least one of tilt and height substantially along at least part of an edge contour of said substrate.

18. A method according to claim 17, wherein the measuring comprises measuring at least along one of a plurality of straight lines that together follow said edge contour, a step-by-step path along said edge contour, and a contour substantially equal in shape to said edge contour.

19. A method according to claim 14, further comprising determining said at least one of tilt and height on at least one substrate of a batch of substrates and using said at least one of tilt and height of said at least one substrate to estimate tilt and height for the remaining substrates of said batch.

20. An assembly for determining at least one of tilt and height of a surface of a substrate in a lithographic apparatus, the assembly comprising;

a substrate table configured to move said substrate along at least one path substantially parallel to the surface of said substrate;

a sensor configured to measure said at least one of tilt and height along said at least one path, said sensor including a plurality of sensing spots; and

a memory configured to store measurement data of said sensor for use during a later exposure of said substrate by said lithographic apparatus,

wherein said sensor is configured to measure said at least one of tilt and height with a predetermined subset of the plurality of sensing spots when one or more sensing spots are directed on or outside an edge contour of said substrate.

21. An assembly for determining at least one of tilt and height of a surface of a substrate in a lithographic apparatus, comprising:

a substrate table configured to move said substrate along at least two paths substantially parallel to the surface of said substrate; and

a sensor configured to measure said at least one of tilt and height along each of said at least two paths,

wherein a direction of each of said at least two paths of the substrate is substantially parallel to a direction of a local tangent to a part of an edge contour of said substrate proximate to said path,

and wherein said at least two paths are contiguous and are at least partly inclined with respect to each other.

22. An assembly according to claim 21, wherein the direction of at least one of said at least two paths is at least partly inclined with respect to an exposure scanning direction of said lithographic projection apparatus.

23. An assembly according to claim 21, further comprising a memory configured to store measurement data of said sensor.

24. An assembly according to claim 21, wherein the sensor is further configured to measure said at least one of tilt and height along said edge contour of said substrate in one go.

25. A lithographic apparatus comprising:

a table configured to move a substrate along a path substantially parallel to a surface of the substrate and at least partly inclined with respect to an exposure scanning direction of the lithographic apparatus; and

a sensor configured to measure at least one of a height and a tilt of the surface of the substrate at each of at least three different positions of the substrate table along the path,

wherein movement of the substrate table from each of the at least three positions to a subsequent position includes movement along both of a first axis substantially parallel to the exposure scanning direction and a second axis substantially parallel to the surface of the substrate and orthogonal to the first axis.

26. The lithographic apparatus according to claim 25, said apparatus further comprising a memory configured to store information based on said at least one of a height and a tilt at said each of at least three different positions.

27. The lithographic apparatus according to claim 25, wherein at least a part of said path is proximate to a part of an edge contour of the substrate, and wherein the path is parallel to a local tangent of the part of the edge contour.

28. The lithographic apparatus according to claim 25, wherein said sensor is configured to measure a plurality of heights of the surface of the substrate at each of the at least three positions.

29. The lithographic apparatus according to claim 25, wherein the sensor is configured to measure at least one of a height and a tilt of the surface of the substrate at each of at least three different positions of the substrate table along the path while the substrate table moves in a line substantially parallel to the surface of the substrate and at an angle to the exposure scanning direction.

30. The lithographic apparatus according to claim 25, wherein the lithographic apparatus is configured to expose a radiation-sensitive portion of the substrate, based on said at least one of a height and a tilt at each of said at least three different positions.